



## Voluntary Leadership: Selection and Influence

Emrah Arbak, Marie Claire Villeval

### ► To cite this version:

Emrah Arbak, Marie Claire Villeval. Voluntary Leadership: Selection and Influence. Social Choice and Welfare, 2013, 40 (3), pp. 635-662. halshs-00664830

**HAL Id: halshs-00664830**

**<https://shs.hal.science/halshs-00664830>**

Submitted on 10 Apr 2012

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Endogenous Leadership: Selection and Influence

Emrah Arbak<sup>a</sup> and Marie-Claire Villeval<sup>b#</sup>

*November 2011*

## Abstract

In social dilemmas, leading a team by making heroic efforts may prove costly, especially when the followers are not adequately motivated to make similar sacrifices. Attempting to shed light on what drives people to lead, we devise a two-stage public good experiment with endogenous timing. We show that leading by making generous contributions is widespread and relatively persistent. At least three motives explain this behavior. Some use leadership strategically to distill personal gains, with the expectation that others will respond by being at least as generous. Others are more altruistic, volunteering to lead even though this may come at a personal cost. Yet for another fraction of volunteers, a concern for maintaining a positive social image appears to be responsible. We also find that voluntary leaders are not necessarily more influential than randomly-chosen leaders.

<sup>a</sup> University of Lyon 2, F-69007, Lyon, France; CNRS-GATE, F-69130, Ecully, France; and Centre for European Policy Studies, Brussels, Belgium. Email: [emrah.arbak@ceps.eu](mailto:emrah.arbak@ceps.eu).

<sup>b#</sup> Corresponding author. University of Lyon 2, F-69007, Lyon, France; CNRS-GATE, 93 chemin des Mouilles F-69130 Ecully, France. Email: [villeval@gate.cnrs.fr](mailto:villeval@gate.cnrs.fr)

*JEL-Codes:* M54, J33, A13, C92, D63

*Keywords:* Leadership, Self-selection, Influence, Voluntary Contribution, Experiment.

*Acknowledgements:* We are grateful to C. Plott, D. Friedman, R. Sugden, D. Engelmann, H.T. Norman, D. Zizzo, M. Muendler, and participants at the workshop on Communication and Incentives at the University of California in Santa Barbara, the Economic Science Association meetings in Atlanta and Nottingham, the conference of the Association for Public Economic Theory in Hanoi, the Conference on the Analysis of Firms and Employees in Nurnberg. The paper has benefited from comments during seminar presentations at Royal Holloway University, East Anglia University, University of Rennes. We are also grateful to the editor and two anonymous reviewers. We thank J. Rossier, A.-R. Blais and F. Martinez for their help regarding the psychological questionnaire and R. Zeiliger for programming the experiment presented in this paper. This research was supported by grants from the Rhône-Alpes Region (Cible program).

## I. INTRODUCTION

Among the major commitments to be a leader, Michael C. Jensen insists on the following: "Be committed to delaying gratification" (Jensen, 2005), adding that, "the message is the same as that for physical conditioning: no pain, no gain." (*ibid*, p.3). Perhaps one of the key differences between voluntary leadership and perfunctory authority, being a leader requires energy, patience and calls for potential self-sacrifices. Leaders typically put their self-interests, i.e. careers, own income, reputation, etc., at risk for the ultimate purpose of steering their groups towards desired collective goals. Despite potential private losses, voluntary leadership is frequently observed in various forms in classrooms, youth organizations, work teams, or welfare agencies (see Harris, 2007 for a review).

Two natural questions thus arise: If leading is risky, why are some people willing to pay the price? And second, do these real sacrifices enhance one's influence over others? Attempting to answer these questions, we devise a novel experiment based on a repeated two-stage linear public good game with *ex ante* symmetric information. Participants may choose to contribute in any one of the two stages, either in the first stage before others (i.e. as a leader) or in the second stage, after having observed the leader's contribution.

With the notable exception of Stackelberg's analysis of imperfect competition, economists' interest in leadership is relatively recent. Most studies have focused on leadership-by-example in charitable fundraising and a variety of social dilemmas involving public goods.<sup>1</sup> A significant amount of work in this area has been built on theoretical models that have sought to explain leadership in the presence of asymmetric information. These models

---

<sup>1</sup> Announcing past contributions in fundraisers exerts a significant impact on current donations (List and Lucking-Reiley, 2002; Frey and Meier, 2004; Croson and Shang, 2008).

typically focus primarily on how better-informed leaders may be influential in improving group efficiency (Hermalin, 1998; Vesterlund, 2003; Andreoni, 2006; Komai *et al.*, 2007).<sup>2</sup>

In our game, there are no information asymmetries between players. Theoretical work on leadership with symmetric information argues that leaders may exert some influence when followers are likely to mimic their actions, (Sugden, 1984; Arce, 2001; Huck and Rey-Biel, 2006). Experiments have confirmed that followers are responsive to leaders' contributions when leaders are chosen either randomly (Moxnes and van der Heijden, 2003; Gächter and Renner, 2006), by their behavioral attributes (Gächter and Renner, 2005; Kumru and Vesterlund, 2010), or collectively by a voting procedure (Güth *et al.*, 2007; Levy *et al.*, 2011; Levati *et al.*, 2007; Kocher *et al.*, 2009). Our game departs from most of the existing research in that individuals may select their role voluntarily. The only thing that distinguishes a leader from others is the timing of the contributions: Leaders move first and, in doing so, become vulnerable to any free-riding behavior by their followers. To our knowledge, the only other public good experiments in which leadership is self-selected are Rivas and Sutter (2011) and Nosanzo and Sefton (2011). These two aspects of our design allow us to pinpoint the main motives behind the emergence of leadership, eliminating other potential explanations such as access to superior information, ability to exercise discretionary power to allocate the public good, etc.<sup>3</sup>

---

<sup>2</sup> In the literature with asymmetric information, the only model with voluntary leaders is Andreoni (2006) who models the leader in fundraising as an individual who may pay to become informed about the quality of the public good. For experimental evidence on leading-by-example in the presence of asymmetric information but randomly-chosen leaders, see Potters *et al.* (2005), Potters *et al.* (2007), and Meidinger and Villeval (2003).

<sup>3</sup> In contrast to our study, in Güth *et al.* (2007) and Levati *et al.* (2007), leaders are granted the ability to exclude certain members from the group. In Gürer *et al.* (2009) leaders can motivate their teammates by means of incentives. In Potters *et al.* (2009) team leaders have discretion to allocate the proceeds from team production. These sources of power are likely to count as additional motivators of leadership.

The studied environment is clearly unfavorable to the emergence of leadership. At least three types of motives may be at suspect for explaining voluntary leadership in this context. First, subjects may be pre-disposed to be kind to others (Andreoni, 1990, 1998). For these selfless individuals, leading is meaningful only to the extent that it motivates others to contribute more. Altruism, however, may not be sufficient to explain the decision to move first as shown by Warr (1982) and by Varian (1994) who demonstrates in a quasi-linear public good game that instead of moving first, selfless individuals may prefer waiting until the last moment to ensure that the public good is sufficiently financed.

The second category represents a more self-centered motive. As first mentioned by Olson (1965), formalized by Andreoni (1990) and later verified by Andreoni and Petrie (2004), public displays of generosity may be inspired by a desire to win the respect and praise of others. In this light, voluntary leadership may be an effective tool to publicize one's honorable intentions, in that it is equivalent to acting 'with one's eyes closed' before others. As in Glazer and Konrad (1996) and Harbaugh (1998), large contributions may also be a key indicator of status. Some leaders may also be motivated with a desire to maintain their image (as examined by Mathur (1996), Duncan (2004) and Benabou and Tirole (2006) in different contexts). In our experiment, seemingly generous leadership that fits into this category of motives should subside once actions are exercised in private.

The third motive is related to beliefs regarding others. As already noted, the expectation that followers may reciprocate to initial contributions could be a key motivator to act first (Sugden, 1984). After all, a leader's earnings are closely linked to how much she can inspire others to do the same and experimental evidence supports the idea that (randomly-chosen) leaders act as "belief managers" (Gächter and Renner, 2006; Gächter *et al.*, 2010).

If followers are expected to conform strongly, even completely self-absorbed individuals may choose to lead with strategic contributions (see Huck and Rey-Biel (2006) for a model with conformity).

Several aspects of our experiment allow us to discriminate between these motives. First, when several players volunteer to lead, all candidates are asked to specify their contributions even though only a single (randomly-chosen) leader is chosen among them (which differs from Rivas and Sutter, 2011). Discarded candidates are allowed to revise their contribution. This artifact allows us to get an understanding of how a leader would behave as a follower, potentially helping us distinguish altruistically motivated leaders from others. Second, certain characteristics of each player are made public to all the teammates. Notably, a sign of a player's generosity is made public information in the Attribute treatment. Last, we administer a personality test to examine whether participants' psychological traits are good predictors of their behavior, as suggested by the theory of traits in psychology (Judge *et al.*, 2002).

In addition to identifying what motivates leaders, we also examine whether voluntary leadership is more efficient than random assignment. On the one hand, those who choose to lead willingly are expected to contribute more generously than those who are forced to act as a leader. This would imply that voluntary leadership is more efficient when the contributions of leaders and follower are indeed correlated. On the other hand, voluntary followers are likely to be swayed less easily and are expected to contribute less than other subjects. In order to clarify the net impact of these two opposing forces, leaders are randomly selected in the Imposed Leader treatment.

Our findings show that voluntary leadership is widespread and persistent even though it involves personal costs. Several personal characteristics are singled out as the main determinants of one's decision to lead. In particular, most leaders are not purely selfless individuals, giving away their earnings unconditionally. A participant's beliefs about others' responsiveness are an important determinant of her decision to lead and level of contributions. In turn, purely selfish gains also do not appear to be the sole motive since leadership behavior is persistent and since more charitable individuals appear more likely to lead. Regarding contributions, frequent leaders contribute substantially more than other players, both as leaders and followers. Moreover, while rejected female candidates appear equally generous in both roles, rejected males are more likely to be motivated by personal considerations. Lastly, although groups with voluntary leaders are more efficient, followers appear more responsive to randomly-chosen leaders, possibly due to a sorting effect.

The remainder of the paper is organized as follows. Section 2 reviews the related experimental literature. Section 3 details our experimental design and the procedures. Section 4 then provides a detailed discussion of the results. Section 5 concludes the paper.

## II. RELATED EXPERIMENTAL LITERATURE

Few studies have addressed the idea of endogenous leadership. In some experimental studies, the assignment is based on the participant's behavior in earlier parts of the game. In Gächter and Renner (2005), the leader is designated based on his past contribution behavior. In Kumru and Versterlund (2010), the assignment is based on a participant's performance in a preliminary trivia quiz and the leader's influence is positively correlated with her status. In none of these studies, however, leaders are picked among volunteers.

Other studies introduce a voting mechanism. When some players are more informed than others and group members are allowed to vote in favor of either a sequential game with informed leaders or a simultaneous game, Potters *et al.* (2005) show that most players choose the sequential game to maximize their own welfare. In a symmetric information setting, Güth *et al.* (2007) allow groups to vote on whether they want a leader; in one of the treatments, the participants are further allowed to vote for their preferred leader. The authors find that when leaders have no power to exclude certain members, the participants refuse being the leader. In addition to how leaders are selected, participants have information about the past behavior of their team members, which is not the case in our design. Studying decision-making under risk, Kocher *et al.* (2009) allow the leaders to be elected by their team members, finding that collectively chosen leaders are more likely than randomly-chosen leaders to follow the majority decisions, even when these differ from their self-interests. In Levy *et al.* (2011), participants elect a leader based on their suggested strategies. They cannot vote for themselves, which means that leadership depends on how enticing a player's proposal appears to others. The authors find that a suggestion is followed more readily when it comes from a human leader than when generated by a computer. They do not aim, however, at investigating the motives of voluntary leaders.

Two recent experiments study self-selected leaders. Rivas and Sutter (2011) allow the group members to volunteer to move first and find that voluntary leaders shift contributions upwards. In contrast to our experiment, the groups may contain as many leaders as volunteers. The authors also do not focus on the determinants for becoming a leader. Nosanzo and Sefton (2011) expand upon Varian (1994)'s endogenous timing game, allowing subjects to move first with a low contribution, effectively committing to free-ride



and forcing others to provide the public good of their own. The authors' results show that on average most participants delay their contributions, demonstrating that the opportunity to commit first does not necessarily aggravate the free-riding problem.

Our design is also related to endogenous timing games. Huck *et al.* (2002) investigate a duopoly game in which a firm chooses between moving first or after observing the decision of the other firm. Though theory predicts the emergence of Stackelberg leadership, participants are more willing to settle for Cournot outcomes. Other experimental tests of leadership in duopoly games can be found in Fonseca *et al.* (2006). In contrast with these studies, we consider a public good game as it captures the most crucial aspects of group behavior, helping us identify the relevance of social preferences in the decision to lead.

### III. EXPERIMENTAL DESIGN AND PROCEDURES

#### *Design*

Each session consists of a repeated sequential public good game, comprising of 30 periods with randomly formed teams, as well as pre- and post-game phases that are used to elicit information on the participants. The repeated game is divided into three blocks of 10 periods, alternating between the benchmark and alternative treatments. The treatments are distinguished from one another by (i) the leadership selection processes and (ii) the revelation of player-specific attributes to one's teammates. In the benchmark treatment, the leadership selection is endogenous and all attributes remain hidden. In turn, the "Imposed leader" and "Attribute" treatments differ from the benchmark treatment as they randomize the selection of leaders and reveal attributes publicly, respectively. The pre-game period is used to elicit information on the attributes of the players, which are then used in the Attribute treatment. The post-game period is used to gather information on the participants'

psychological traits, based on the Big Five personality test. The experimental setup is made common information to all participants in the instructions (see Appendix).

### *Benchmark treatment*

Each group member is endowed with 20 units, equivalent to 25 Euro cents. This endowment can be used to either contribute to a public account or be kept aside in a private account. Public account pays a positive return to each member of the group. The payoff  $\pi$  of participant  $i$  of contributing an amount  $c$  to the public account depends on others' contributions, such that

$$\pi_i = 20 - c_i + \frac{1}{2} \sum_{j=1}^3 c_j \quad (1)$$

Note that an individual's marginal return from contributing to the public account is negative, equivalent to  $-1/2$ . This means that if all players are known to be self-centered, none will contribute anything to the public account. In contrast, the efficient outcome is for each participant to contribute all her endowment, since the social marginal return from contributing to the private account is positive, equivalent to  $1/2$ .

The sequential public good game is comprised of two stages. In the first stage, each group member decides whether she is willing to lead the group or not. Those who are willing to move first are also asked to indicate how much they would contribute, should they be chosen to lead. When there are several volunteers, the leadership selection is made randomly among the candidates.<sup>4</sup> The rejected candidates are treated as followers. In the second stage, if there is a leader, the leader's contribution is made public and the followers

---

<sup>4</sup> Allowing several leaders would pose the challenge of distinguishing the real impact that each would have on the followers. For example, with two leaders with different contributions and attributes, it is not clear which one of the two leaders has a greater influence on the third member. Our design also has the advantage of allowing us to study the revision of contributions between the two stages by eliminated leader candidates.

choose their own contributions simultaneously. The rejected leaders are allowed to revise their contribution, keeping track of their initial and revised contributions. At the end of each period, the contributions and associated payoffs of all team members are made public. Given the endogenous selection procedures, it is possible that no participant is willing to lead. In that case, the three group members move directly to the second stage and contribute simultaneously to the public good. The game is then similar to a standard voluntary contribution mechanism game—the only difference being the fact that simultaneity is an outcome of the endogenous role determination and not imposed on the game.

#### *Attribute treatment*

The Attribute treatment aims to study how the timing and contribution decisions are influenced by the provision of information on the characteristics of the group members in the beginning of each period. The first attribute gives an indication on the generosity of each participant. To elicit this information, the participants are allowed to donate a portion of their €6 show-up fee to a charity of their choice in the pre-game phase in the beginning of the session.<sup>5</sup> If the participant's donation is above the session average, then a *yellow circle* is used to identify the participant. Otherwise, the participant receives a *grey circle*.

We are aware that donations are a noisy measure of a participant's generosity. Indeed, when making their donations, participants know that this information may be made public.<sup>6</sup> Thus, a donation may be strategically used to falsely signal one's intention to contribute

---

<sup>5</sup> The charities were Handicap International, Medecins Sans Frontieres and the United Nations Children's Fund (UNICEF). We offered the choice between three NGOs to avoid that some players refuse to donate not because of the idea of giving up money but because they dislike a specific organization.

<sup>6</sup> Only the instructions of sessions containing the Attribute treatment state that the symbols (grey or yellow circles) may be disseminated to the others during the session. In the sessions containing the Imposed leader treatment, no symbols were assigned as symbols were only used to convey information about generosity.

and is not a perfect measure of inherent generosity. However, a yellow circle is only awarded to those with above-average donations. This makes it costly for participants to use their donations as fake signals; the more players do the same, the higher is the average and the costlier the signal. It is therefore reasonable to expect that in equilibrium those who receive a yellow circle are more generous than others, which could help potential leaders to form beliefs about their followers.<sup>7</sup>

The second attribute is the participant's gender, which is self-reported at the beginning of the experiment. This allows us to measure the potential impact of the gender composition of the groups on leadership behavior. But the main reason for displaying a second attribute is reducing the risk of a demand effect due to the salience of a single attribute.

#### *Imposed Leader treatment*

Unlike the Benchmark and Attribute treatments, in the Imposed Leader treatment the leader is selected entirely randomly. No information about attributes is displayed. This treatment helps untangle whether endogenous selection is indeed a more efficient method of extracting maximal cooperation within a group.

#### *Personality test*

At the end of the session, the participants answered to the 60 questions of the Five-Factor Inventory personality test ("Big Five", Costa and McCrae, 2004) to investigate whether specific traits distinguish voluntary leaders and followers. The responses provide a concise measure of the following five traits: neuroticism (i.e. tendency to experience psychological

---

<sup>7</sup> Finally, asking players to make their donation before distributing the instructions for the public good game would give a less noisy measure of generosity; but using next this information in the main game without informing the participants in advance could be considered as deception.

distress), extraversion (i.e. pronounced engagement with outside world), openness (i.e. being open to new ideas and intellectually curious), agreeableness (i.e. tendency to be compassionate and cooperative), and conscientiousness (i.e. tendency to show control and self-discipline). We acknowledge, however, that the information obtained through the personality test is likely to be noisy.<sup>8</sup>

### *Predictions*

When all participants are assumed to be purely selfish, the predictions are identical in all treatments. The subgame perfect equilibrium of such a one-shot game is to contribute nothing in the second stage since every individual is better off by keeping his endowment for himself regardless of what the others do. Dynamic considerations, such as reputation building, are also assumed to be absent since participants are re-matched randomly after each period. In short, if everyone is assumed to behave selfishly, there should be no real motive to make any meaningful contributions as leaders. Leadership may be prevalent, however, when followers are believed to be responsive to the leader's contributions. Such beliefs may be formed more easily in the Attribute treatment, based on the information of participants' donation behavior. Even purely self-centered participants may emerge as leaders with the expectation that the followers will reciprocate by being equally or more generous. This would be the case if the followers are expected to be conformist, as described in the model of Huck and Rey-Biel (2006). In our game, a participant earns more

---

<sup>8</sup> The participants were paid an additional €2 for completing the test and they were asked to answer sincerely. Although we cannot exclude that some participants answered the questionnaire randomly, the answer sheets do not reveal that such behavior was widespread, which would be the case if the marked answers were systematically chosen to be alternating, non-alternating, etc. Admittedly, eliciting traits through the use of direct incentives could give more confidence in the validity of the responses; however, conditioning earnings on responses is also likely to bias the results. Moreover, the Big Five method has been validated in psychology as well as in economics; see, most notably Burks *et al.* (2007).

than his endowment when others' contributions surpass his own. With this in mind, we monitor the ratio of the follower's collective contributions to the leader's contribution:

$$\frac{\sum_{F \neq L} c_F}{c_L} \quad (2)$$

The ratio may be interpreted as an indicator of the followers' responsiveness to the leader's contribution. When it is greater than one, leadership may be explained by an anticipation of individual gains; otherwise, leading involves real costs, implying that non-pecuniary motives must be at play. Two distinct motives may explain why leaders may be willing to accept costs. An altruist will bear individual costs in exchange for an improvement of the group's welfare or to teach others how to reach the optimum. Others will pay the price of being a leader in order to maintain a positive social image. One difference between these two motives is that an altruist is expected to contribute more or less the same amount in both roles. In turn, players who are purely concerned with their image are expected to contribute less or even nothing as followers. Our design keeps track of how leaders change their contribution after a rejection and allows us to distinguish these motives.

### *Procedures*

The experiment was computerized using the REGATE software (Zeiliger, 2000). Sessions were conducted in the laboratory of GATE in Lyon, France. A total of 141 participants (72 females and 69 males) were recruited from undergraduate classes in local engineering and business schools. Seven sessions involved 18 participants and one session involved 15 participants. The treatment structure of each session is detailed in Table 1.

*(Table 1 about here)*

Upon arrival, each participant drew a tag from a bag, indicating the name of his computer. The instructions for the preliminary and the first parts were distributed and read aloud. We added a description of each of the three humanitarian NGOs and a form to be filled out by the participants requesting a receipt to prove the payment of the total amount of donations to these NGOs. Participants were quizzed on their understanding of the rules of the game. Questions were answered in private and the accuracy of responses was checked. Groups were re-matched randomly between periods in order to ensure that participants are unaware of the identities of their teammates throughout the game. At the end of each block of 10 periods, the instructions of the next part were distributed and read aloud. At the end of session, we administered both the personality test and a demographic questionnaire.

An average session lasted about 70 minutes. The average donation was €1.04. The participants earned an average €15.70, including the fraction of the show-up fee they chose to keep. Each participant was additionally given €2 for completing the personality test. An assistant who was not aware of the content of the experiment helped participants with their donations and payments in private, all of which was made common information at the beginning of the session.

#### IV. RESULTS

This section gives an overview of our results using descriptive statistics and econometric estimates. Tables 2 and 3 summarize the earnings, contributions, and the ratio of followers' contributions to the leader's contribution. Tables 4-7 provide an econometric analysis of the determinants of leadership decision, leaders' contributions, revisions of rejected leaders and followers' contributions, respectively.

All of the models used in the econometric analysis report robust standard errors using clustering at the individual level. This method of correcting the standard errors is justified because the same individuals make repeated decisions and this accounts for the intra-individual correlation. Not clustering the robust standard errors would lead to seriously biased standard errors and erroneous conclusions on the significance of some variables (Wooldridge, 2003).

A number of core independent variables are used consistently across the different empirical treatments. A time variable identifies the evolution of behavior over time (*“Period”*). Dummies for the Attribute and Imposed leader treatments are included to control for treatment-specific results, with the benchmark treatment as the reference category. Two additional variables are included to control for both the order of treatments and the composition of sequences by including a dummy controlling for *“Session with Attribute treatment played first”* and another for *“Session including Imposed leader treatment”*. Interaction terms are added to measure to what extent the group composition is influential in the Attribute treatment, i.e. whether the participant is matched with two below-average donors (*“Attribute treatment\*Matched with 2 low donors”*) or above-average donors (*“Attribute treatment\*Matched with 2 high donors”*), the mixed composition being the reference category.<sup>9</sup> Other variables account for more personal characteristics. The participant's gender is controlled by a dummy variable (*“Gender”*, equal to 1 for males and 0 for females). The amount donated to charity (*“Donation”*) is included to investigate whether charitable behavior may explain individual decisions. The two variables are also

---

<sup>9</sup> We omit the variables controlling for the gender composition of the team (*“Attribute treatment\*Matched with 2 females”* and *“Attribute treatment\*Matched with 2 males”*), which are never significant.



interacted with gender ("*Donation\*Gender*") to capture the effect of gender on donations. A dummy for Imposed leader treatment ("*Donation\*BIB*") is also used to account for potential strategic and non-strategic considerations in different sequences. Lastly, all the tests include the normalized scores for the five personality factors.

*Result 1. Voluntary leadership is common, persistent and costly, especially in later rounds.*

In the Benchmark and Attribute treatments where leadership selection is endogenous, approximately a quarter of all participants are willing to lead (25.1% and 26.7%, respectively). Consequently, over 57% of all groups have a leader. Moreover, although the willingness to lead diminishes over time, a substantial proportion of players continue to lead even in the last few periods. Figure 1 displays the evolution of the proportion of leader candidates by treatment and by block of periods.

*(Figure 1 about here)*

As shown in Figure 1, the share of leader candidates starts from a high of one-third of all participants in the first ten periods of both treatments and stabilizes around one-fifth of all candidates in the last ten periods.

Endogenous leading is costly, especially for frequent candidates and in later rounds. Table 2 displays the earnings of leaders and followers according to the frequency of voluntary leadership. The table distinguishes between three categories of individuals based on their frequency of candidacy. Low frequency candidates are those who are willing to lead less than 15% of the rounds; high frequency candidates are willing to lead in more than 35% of the rounds; lastly, medium frequency candidates are in between these two extremes.

*(Table 2 about here)*

Table 2 shows that leaders earn consistently less than followers, with the average earnings of a follower surpassing the average earnings of a leader by approximately 5 points, or 20% to 25% depending on the treatment and leadership frequency. The fact that more frequent candidates earn less than 20 points—the endowed amount—hints that leadership may be motivated at least in part by non-pecuniary incentives. Additional confirmation of the costliness of leading is given by the analysis of contributions in Table 3.

*(Table 3 about here)*

Table 3 indicates that leaders contribute substantially more than followers on average. In the Benchmark treatment, the average leaders' (followers', resp.) contribution is 11.97 (1.84, resp.); in the Attribute treatment, the average is 12.12 (1.40, resp.), while in the Imposed leader treatment, it is 9.65 (5.03, resp.). The costs of leading appear to increase over time as the follower-to-leader contribution ratios decrease substantially over time. In the first ten rounds, the collective contributions of the followers more than match the leader's contribution on average. The ratio dips below unity and remains more or less constant in the subsequent periods. In the last ten rounds the ratio falls to 0.75 in the Benchmark and 0.74 in the Attribute treatment, implying substantial losses for the leader.

*Result 2. Expectations, gender, and charitable behavior are the main determinants of the decision to lead.*

To assess the determinants of the decision to lead, Table 4 gives the estimations of five Probit models with robust standard errors and clustering at the individual level. The regressions in columns (1) to (3) analyze the candidacy probabilities. Regression (1) pools the data from both the Benchmark and the Attribute treatments, i.e. the treatments where

leadership is endogenously determined. Regressions (2) and (3) consider each treatment separately. Models (4) and (5) study the probability of remaining a candidate in the Benchmark and the Attribute treatments, respectively, conditional on leading in the previous period. In addition to the set of independent variables that are common to all the econometric treatments, a variable capturing the running number of periods without a leader is also included in order to examine whether leading may be influenced by a motivation to break away from successive periods of low contributions. We also control for learning from experience in last period by including a “*success in t-1*” variable, which corresponds to the followers-to-leader contribution ratio in the previous period: The higher the ratio, the more beneficial is leadership.

*(Table 4 about here)*

Table 4 shows that leadership behavior is more common in the Attribute treatment, with a marginal effect of 4.6%, possibly because subjects can more easily form beliefs about their impact as a leader. Indeed, models (1) and (2) indicate that leadership behavior is conditional on the perceived responsiveness of the followers. In the Attribute treatment, being matched with two below-average donors reduces the leadership likelihood by 6.7%, implying that potential leaders most likely interpret a below-average donation as a signal of the participants’ willingness to free ride.<sup>10</sup> Likewise, having more responsive followers in the past periods, as indicated by a high value of “*success in t-1*” variable in regressions (4) and (5), is a clear motivator for remaining as a leader in two successive periods. The

---

<sup>10</sup> Also, being matched with two high donors increases a participant's willingness to lead, although the effect is not significant. The perceived relationship between charitable behavior and contributions is noisy at the upper-end, either because the high donations are not considered as a credible signal of generosity or because above-average donors are not expected to be sufficiently responsive to guarantee positive returns.

statistically significant coefficient estimates for the number of periods in columns (1) and (3) may also be an indicator that as followers become less responsive over time, leadership becomes less widespread. Finally, the number of consecutive periods without a leader decreases significantly the likelihood of leading, once again highlighting the importance of expectations. In short, leadership decision is clearly reinforced when the followers are expected to be responsive.

Among the individual characteristics, the gender- and donation-related variables are the most consistent determinants of the decision to lead.<sup>11</sup> In the Benchmark treatment, more charitable donors are more likely to lead and remain as leaders in successive periods. Moreover, although males are more likely to lead in general (with a marginal effect of approximately 10%), highly charitable females are substantially more likely than all other participants to become leader candidates. Indeed, the marginal effect of the interactive variable “*Donation\*Gender*” offsets the marginal effects of “*Donation*” in columns (1) and (2), implying that charitable males are just as likely to become leaders as their less charitable peers. However, both gender differences vanish in the Attribute treatment (columns (3) and (5)). Complementing these results, descriptive statistics show that the average donation of high frequency candidates is almost twice that of low frequency candidates. In the sequences including the Attribute treatment, the average donation of the low frequency candidates is 70, that of the medium frequency candidates 83.5, and that of the high frequency candidates 139.3. The corresponding values in the sequences without

---

<sup>11</sup> Among the personality factors, individuals who are more open to new ideas and less conformist are slightly more likely to lead in the Benchmark treatment. In contrast, those who are more compassionate and agreeable are more likely to be followers and less likely to lead their group continuously. The personality traits, however, do not seem to exert a strong influence on the leadership decision.

the Attribute treatment are 45, 61 and 91.4, respectively. Statistical tests confirm that frequent leaders have a different donation behavior than the other players.<sup>12</sup> In sequences including the Attribute treatment, it is possible, however, that donations may be used strategically to falsely signal one's own cooperation likelihood. Donations in these sequences appear greater than the averages in sessions with no Attribute treatment. However, statistical tests fail to reject the null hypothesis that the distributions of donations are identical for the different sequences.<sup>13</sup> They give no support to the idea that donations are used strategically.

*Result 3. Expectations and candidacy frequencies are the main determinants of leaders' contributions.*

Table 5 provides an analysis of the leaders' motivation by considering the determinants of their contributions, providing the regression results for Tobit models with robust standard errors and clustering at the individual level. We use a Tobit specification as the data is truncated. The first model (column (1)) pools the data from all treatments while the remaining regressions (columns (2)-(4)) consider each treatment separately. In addition to the core set of explanatory variables mentioned earlier, we include the “*frequency of candidacies*” (that takes the values 0, 1, and 2, for low, medium, and high frequencies) and

---

<sup>12</sup> A Kolmogorov-Smirnov test, with each individual as a unit of observation, rejects the equality of the distribution of donations of high frequency candidates and others collectively ( $p=0.054$ ). Additional pairwise Kolmogorov-Smirnov tests also reject the equality of distributions of the high frequency and low frequency candidates, with  $p=0.048$ . In turn, the equality of donation distributions cannot be rejected for high and medium frequency candidates ( $p=0.370$ ) as well as medium and low frequency candidates ( $p=1.000$ ).

<sup>13</sup> A Kolmogorov-Smirnov test, with each individual as a unit of observation, fails to reject the equality of the donations with all sequences containing the Attribute treatment and the other sequences ( $p=0.345$ ). The same conclusion is reached by separate pairwise Kolmogorov-Smirnov tests for the three sequences used in the experiment, or Benchmark-Attribute-Benchmark (BAB), Attribute-Benchmark-Attribute (ABA), and Benchmark-Imposed Leader-Benchmark (BIB) sequences, with  $p=0.964$  for the sequence pairs BAB-ABA;  $p=0.643$  for BAB-BIB; and  $p=0.217$  for ABA-BIB.

the ratio of consecutive candidacies to the total current number of candidacies (“*persistence*”) to capture the effect of more persistent leading strategies.

(Table 5 about here)

The econometric results confirm that voluntary leaders contribute significantly more in the Attribute treatment than in the Benchmark; imposed leaders contribute less than in the Benchmark, but not significantly so. Interestingly, frequent leaders contribute significantly more than other candidates, especially in the Attribute and Imposed Leader treatments as well as for the pooled regression. Leaders contribute less when they know they are matched with two low donors, possibly because of lower expectations regarding the followers’ willingness to contribute; they contribute more when matched with two high donors, but not significantly so.<sup>14</sup> Other personal attributes matter less. In particular, neither the candidates’ gender nor their donation explain how much leaders contribute.<sup>15</sup>

*Result 4. Eliminated male leaders tend to revise their contributions downwards while eliminated female leaders tend to respond to the actual leader.*

Due to the presence of several candidates, 25% (155 out of 463) and 26% (87 out of 249) of all candidates have been eliminated in the Benchmark and Attribute treatments, respectively. In our data, 22% of the eliminated candidates revise their contributions upward and 41% revise downward. Males systematically revise their contributions downwards by an average of 27%. In contrast, female candidates revise their contributions

---

<sup>14</sup> This result is consistent with the findings of Gächter *et al.* (2010) with randomly-chosen leaders. They show that reciprocators contribute more as leaders than selfish players partly because of their social orientation and also because they are more optimistic about the reciprocal responses of followers.

<sup>15</sup> Among the personality traits (suppressed in the table to save space), openness has a significant positive impact ( $p=0.056$ ) while neuroticism a negative impact ( $p=0.011$ ), but only in the Attribute treatment.

upwards by an average of 15%. Figure 2 depicts the average revisions of rejected male and female candidates when the contribution of the actual leader is inferior or superior to the candidate's original contribution. A negative value indicates a downward revision.

*(Figure 2 about here)*

When the actual leader's contribution is inferior, both males and females reduce their contributions, although the downward adjustment is stronger for males. When the actual leader's contribution is superior, females increase their contributions whereas eliminated male candidates revise downwards.<sup>16</sup> In order to analyze the determinants of revised contributions, we estimate an ordered Probit model with robust standard errors and clustering at the individual level, in which the sign of revised amount equals +1 for upwards revisions, 0 if no revision occurs, and -1 if the revision is downwards. We also estimate an OLS model with clustered robust standard errors to explain the amount of revision. The contribution of the actual leader is included in the independent variables. Table 6 reports the results.

*(Table 6 about here)*

Table 6 confirms that eliminated male leaders are significantly more likely to revise their contributions downwards, no matter how much the actual leader has contributed. Since becoming a leader and contributing a substantial amount may involve pecuniary losses,

---

<sup>16</sup> Although they revise their contributions downwards, the eliminated candidates contribute nearly three times more than self-selected followers. Indeed, the average second-stage contribution of eliminated leaders is 10.17 while self-selected followers contribute 2.87 in the Benchmark and the Attribute treatments pooled together. We do not have enough independent observations to apply systematic non-parametric statistical tests. An imperfect alternative is to use the data from the first three rounds of the pooled Benchmark and Attribute treatments given that most people are teamed with new subjects in the beginning of the game. Mann-Whitney U tests conducted under these conditions reject the null hypothesis of no difference between the contributions of an eliminated candidate and a (self-selected) follower for both females ( $p=0.006$ ) and males ( $p=0.022$ ). The test accepts the null hypothesis of no difference between an actual leader's contribution and an eliminated candidate's revised contribution ( $p=0.385$ ) for females but rejects it for males ( $p=0.009$ ). These results provide further support to the presence of selfless motives in leadership.

male candidates are likely to be self-regarding in a different manner, possibly concerned by maintaining a positive image. When these candidates are refused the role, due to multiple leaders, their behavior changes abruptly and they become less cooperative. Female candidates, on the other hand, respond to the actual leader's contribution, just like the followers who are conditional cooperators.

*Result 5. Although having a leader improves followers' contributions, followers are more responsive to randomly-chosen leaders, most likely due to a selection effect.*

Leaders' influence on others can be measured in two distinct ways. One can either compare the average second stage contributions with and without a leader or examine the ratio of followers' contributions to the leader's contribution.

A re-examination of Table 3 shows that having a leader substantially improves followers' contributions. Indeed, in groups with no leader, the average contribution of a follower is 1.84 points in the Benchmark and 1.40 in the Attribute treatment. In groups with a leader, these contributions rise to 5.52 points in the Benchmark and 5.23 points in the Attribute treatment. Perhaps more surprisingly, followers are even responsive to imposed leaders, contributing an average 5.03 points. As a second observation, an average follower matches nearly half of the leader's contribution. Indeed, the pair-wise correlation coefficients between the actual leader's contribution and the two followers' contributions are 0.44, 0.49 and 0.59 in the Benchmark, Attribute and Imposed leader treatments, respectively. In short, having a leader makes a difference, even when the role is imposed.

In order to assess more deeply the determinants of followers' contributions, we estimate the econometric models reported in Table 7. The first column in the table gives the results of a



random-effects Tobit model with robust standard errors and clustering at the individual level in which we pool the data from the three treatments. In addition to the usual explanatory variables, we include the actual leader's contribution, a dummy indicating whether the participant has been a rejected leader candidate, and the participant's leadership frequency. Next, by means of ordered Probit models with robust standard errors and clustering at the individual level, we estimate the determinants of the ratio of the followers' contributions to the leader's contribution to capture the leader's influence. The dependent variable equals 0 if the ratio is less than 0.5, 1 if the ratio lies between 0.5 and 1, and 2 if it is equal to or greater than 1. The estimations are based both on the pooled data (column (2)) and the three treatments separately (columns (3) to (5)).

*(Table 7 about here)*

Interestingly, Table 7 confirms the observation that voluntary leaders are not necessarily more influential than randomly-chosen leaders.<sup>17</sup> In fact, followers contribute more and are more responsive in the Imposed leader treatment (columns (1) and (2)). Other results show that this rather surprising outcome is most likely due to a selection bias. More specifically, some of the randomly-chosen followers include the more generous individuals, who are more likely to appear as leader candidates in other treatments, and may thus be “better” followers. In line with this explanation, eliminated leaders contribute substantially more than the other followers (column (1)) and are more likely to match the actual leader's contribution (columns (2)-(4)). Moreover, individuals who choose to be leaders more

---

<sup>17</sup> Followers also contribute less in the Attribute treatment when they are matched with low donors. Much like in the case for leaders' behavior, this finding confirms the presence of conditional cooperation.

frequently are also more cooperative and responsive to the leader's contributions (columns (1)-(5)).

All in all, result 5 is in contrast with Rivas and Sutter (2011) who find that, compared to exogenous leadership, endogenous leadership has a positive effect on cooperation within groups. In our study, the self-selection bias seems to dominate: Voluntary leaders contribute generously; the same is true for randomly-chosen followers, who are more likely to be leader candidates in other treatments. The difference between the results of the two experiments is likely due to the fact that in our experiment there is a constraint on the number of leaders in a group. This comparison suggests that voluntary leadership is more efficient when several people can try to influence others through their example.

## V. DISCUSSION AND CONCLUSION

Voluntary leadership is frequently observed in community life despite the fact that immediate material gains from setting a good example are not always present. In this study, we test whether leadership may emerge as a persistent choice in a social dilemma game with no assured benefits or direct communication possibilities. Our design allows us to investigate the determinants of leadership. As an artifact, we also monitor how leader candidates behave as followers. Lastly, we examine whether the group's composition has any impact on voluntary leadership and whether imposed leaders are as effective as others.

Our primary finding is that roughly a quarter of the participants are willing to lead even though doing so comes with costs, implying that selfish motives cannot solely explain how participants behave. The decision to lead is influenced by a participant's traits, such as

gender and charitable behavior; however, except for openness and agreeableness, personality traits have little explanatory power.

Three main motives emerge as possible explanations of why participants choose to lead. First, there is evidence of self-interested behavior, particularly in earlier portions of the game when followers remain relatively responsive to leaders' contributions. Also, being matched with less charitable participants in the Attribute treatment reduces one's willingness to contribute as a leader. Such information is most likely used as an indication that the followers will be less responsive and that leadership will be less beneficial.

Our results show that some of the subjects continue to choose to lead and contribute significant amounts even in later rounds of the game when followers are less responsive. Therefore, non-selfish motives are also at play. A second likely motivation is appearing as an influential leader. If being a leader is considered as a high social status among the candidates, the very costs that drive selfish participants may make leading a credible signal of one's social rank. Our results provide some evidence that such motives are at play at least for a fraction of our participants, especially among male candidates. Despite pecuniary costs, these candidates repeatedly choose to lead and contribute substantial amounts, only to revise their contributions sharply downwards if they are rejected the role of a leader.

A third type of motivation is more in line with a more general selfless behavior. These participants accept personal costs for improving the group's overall welfare, no matter what their role may be. The presence of such altruistic motives is supported by several findings. We find a strong correlation between a participant's charitable behavior and the probability to lead, even in sequences in which donations are unlikely to be strategic. Moreover, female

leader candidates act equally generously as followers when rejected the role, adjusting their contribution only to match the contribution of the actual leader.

The determinants of becoming a leader, leaders' contributions and the behavior of eliminated candidates suggest that no single theory is able to explain the decision to lead in a social dilemma game. These results add to the growing body of experimental research showing the importance of heterogeneity of cooperation motives (Burlando and Guala, 2005; Kurzban and Houser, 2005; Bardsley and Moffatt, 2007; Fischbacher and Gächter, 2010).

We also find that voluntary leaders improve the overall efficiency of their groups. However, this appears to be mostly due to the fact that they contribute more than imposed leaders. In particular, followers are less responsive to voluntary leadership. Although this outcome is most likely due to a self-selection effect, it should be acknowledged that making leadership voluntary in and of itself may not be sufficient to achieve substantial efficiency gains. Introducing proper communication channels, better (and more credible) signaling opportunities, sanctions and other forms of incentives, or allowing a multiplicity of first movers may be necessary to improve the efficiency of voluntary leaders. Further research is needed to provide further evidence on these issues.

## REFERENCES

- Andreoni, J., 1990. Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *The Economic Journal* 100, 464-77.
- \_\_\_\_\_, 1998. Toward a Theory of Charitable Fundraising. *Journal of Political Economy*, 1186-213.
- \_\_\_\_\_, Petrie, R., 2004. Public Goods Experiments Without Confidentiality: A Glimpse Into Fund-Raising. *Journal of Public Economics*, 88(7-8), 1605-23.
- \_\_\_\_\_, 2006. Leadership Giving in Charitable Fund-Raising. *Journal of Public Economic Theory* 8(1), 1-22.
- Arce, D., 2001. Leadership and the aggregation of international collective action. *Oxford Economic Papers* 53, 114-37.
- Arrow, K., 1972. Gifts and Exchanges. *Philosophy and Public Affairs* 1, 343-62.
- Bardsley, N., Moffatt, P.G., 2007. The Experimentics of Public Goods: Inferring Motivations from Contributions. *Theory and Decision* 62(2), 161-93.
- Bénabou, R., Tirole, J., 2006. Incentives and Prosocial Behavior. *American Economic Review* 96(5), 1652-78.
- Burks, S.V., Carpenter, J., Götte, L., Monaco, K., Porter, K., Rustichini, A., 2007. Using Behavioral Economic Experiments at a Large Motor Carrier: The Context and Design of the Truckers and Turnover Project. IZA Discussion Papers n°2789, Bonn.
- Burlando, R.M., Guala, F., 2005. Heterogenous Agents in Public Goods Experiments. *Experimental Economics* 8, 35-54.
- Costa, P.T., McCrae, R.R., 2004. A Contemplated Revision of the Neo Five-Factor Inventory. *Personality and Individual Differences* 36, 587-96.
- Duncan, B., 2004. A Theory of Impact Philanthropy. *Journal of Public Economics* 1, 2159-80.
- Eckel, C.C., Grossman, P.J., 2008. Differences in the Economic Decisions of Men and Women: Experimental Evidence, in Plott, C. R. and Smith, V. L. (Eds.), *Handbook of Experimental Economics Results, Vol. I*. New-York: North-Holland, 509-18.
- Fischbacher, U., Gächter, S., 2010. Heterogeneous social preferences and the dynamics of free riding in public good experiments. *American Economic Review* 100(1), 541-556.
- Frey, B. S., Meier, S., 2004. Social comparisons and pro-social behavior. Testing 'conditional cooperation' in a field experiment. *American Economic Review* 94, 1717-1722.
- Fonseca, M.A., Huck, S., Normann, H.T., 2006. Endogenous Timing in Duopoly: Experimental Evidence. *International Journal of Game Theory* 34, 443-56.
- Gächter, S., Renner, E., 2005. Leading by Example in the Presence of Free Rider Incentives. University of Nottingham, *CeDEx Discussion Paper*.
- Gächter, S., Renner, E., 2006. Leaders as Belief Managers for Pro-Social Behavior. University of Nottingham, *mimeo*.

- Gächter, S., Nosanzo, D., Renner, E., Sefton, M., 2010. Sequential vs. simultaneous contributions to public goods: Experimental evidence. *Journal of Public Economics* 94 (7-8), 515-22.
- Glazer, A., Konrad, K., 1996. A Signaling Explanation to Charity. *American Economic Review* 86, 1019-28.
- Gürerk, Ö, Irlenbusch, B., Rockenbach, B., 2009. Motivating teammates: The leader's choice between positive and negative incentives. *Journal of Economic Psychology*, 30, 591-607.
- Güth, W., Levati, M.V., Sutter, M., van der Heijden, E., 2007. Leading-by-example with and without exclusion power in voluntary contribution experiments. *Journal of Public Economics* 91 (5-6), 1023-42.
- Harbaugh, W.T., 1998. What Do Donations Buy? A Model of Philanthropy Based on Prestige and Warm-Glow. *Journal of Public Economics* 67(2), 269-84.
- Harris, M., 2007. Voluntary Leaders in Voluntary Welfare Agencies. *Social Policy & Administration* 24(2), 156-167.
- Hermalin, B., 1998. Toward an Economic Theory of Leadership: Leading-by-Example. *American Economic Review* 88, 1188-206.
- Huck, S., Müller, W., Normann, H.T., 2002. To Commit or Not to Commit: Endogenous Timing in Experimental Duopoly Markets. *Games and Economic Behavior* 38, 240-64.
- Huck, S., Rey Biel, P., 2006. Endogeneous Leadership in Teams. *Journal of Institutional and Theoretical Economics* 162, 253-61.
- Jensen, M.C., 2005. Leadership. *Harvard NOM Research Paper*, 06-05.
- Judge, T.A., Bono, J.E., Ilies, R., Gerhardt, M.W., 2002. Personality and Leadership: A Qualitative and Quantitative Review. *Journal of Applied Psychology* 87 (4), 765-80.
- Kocher, M., Pogrebna, G., Sutter, M., 2009. Other-Regarding Preferences and Leadership Styles, IZA Discussion Paper n°4080, Bonn.
- Komai, M., Stegeman, M., Hermalin, B.E., 2007. Leadership and Information. *American Economic Review* 97(3), 944-7.
- Kumru, C., Vesterlund, L., 2010. The Effect of Status on Charitable Giving. *Journal of Public Economic Theory* 12 (4), 709-35.
- Kurzban, R., Houser, D., 2005. Experiments investigating cooperative types in humans: A complement to evolutionary theory and simulations. *Proceedings of the National Academy of Sciences of the United States of America* 102 (5), 1803-7.
- Levati, M.V., Sutter, M., van der Heijden, E., 2007. Leading-by-Example in a Public Goods Experiment with Heterogeneity and Incomplete Information. *Journal of Conflict Resolution* 51 (5), 793-818.
- Levy, D., Padgitt, K., Peart, S., Houser, D., Xiao, E. 2011. Leadership, cheap talk and really cheap talk. *Journal of Economic Behavior and Organization* 77, 40-52.
- List, J.A., Lucking-Reiley, D., 2002. The Effects of Seed Money and Refunds on Charitable Giving: Experimental Evidence from a University Capital Campaign. *Journal of Political Economy* 110, 215-33.

- Mathur, A., 1996. Older Adults' Motivations for Gift Giving to Charitable Organizations: An Exchange Theory Perspective. *Psychology & Marketing* 13, 107.
- Meidinger, C., Villeval, M.C., 2003. Leadership in Teams: Signaling or Reciprocating? *GATE Working Paper 10-03*.
- Moxnes, E., van der Heijden, E., 2003. The Effect of Leadership in a Public Bad Experiment. *Journal of Conflict Resolution* 47 (6), 773-95.
- Niederle, M., Vesterlund, L., 2007. Do women shy away from competition? Do Men Compete Too Much? *Quarterly Journal of Economics* 122 (3), 1067-1101.
- Nosanzo, D., Sefton, M., 2011. Endogenous move structure and voluntary provision of public goods: theory and experiment. *Journal of Public Economic Theory* 13 (5), 721-54.
- Potters, J., Sefton, M., Vesterlund, L., 2005. After You - Endogenous Sequencing in Voluntary Contribution Games. *Journal of Public Economics* 89, 1399-419.
- \_\_\_\_\_, 2007. Leading-by-example and signaling in voluntary contribution games: An experimental study. *Economic Theory* 33 (1), 169-182.
- Potters, J., Sefton, M., van der Heijden, E., 2009. Hierarchy and Opportunism in Teams. *Journal of Economic Behavior and Organization* 69 (1), 39-50.
- Rivas, M.F., Sutter, M., 2011. The benefits of voluntary leadership in experimental public good games. *Economics Letters* 112 (2), 176-8.
- Shang, J., Croson, R., 2008. The impact of social comparisons on non-profit fundraising. *Research in Experimental Economics* 11 (3), 221-233.
- Sugden, R., 1984. Reciprocity: The Supply of Public Goods through Voluntary Contribution. *The Economic Journal* 97, 772-87.
- Varian, H.R., 1994. Sequential Provision of Public Goods. *Journal of Public Economics* 53, 165-86.
- Vesterlund, L., 2003. The Informational Value of Sequential Fund-raising. *Journal of Public Economics* 87, 627-657.
- Warr, Peter G. 1982. Pareto Optimal Redistributions and Private Charity. *Journal of Public Economics* 19, 131 – 38.
- Wooldridge, J.M., 2003. Cluster-Sample Methods in Applied Econometrics. *American Economic Review, Papers and Proceedings* 93 (2), 133-138.
- Zeiliger, R., 2000. *A Presentation of Regate, Internet Based Software for Experimental Economics*. <http://www.gate.cnrs.fr/~zeiliger/regate/RegateIntro.ppt>, GATE.

Table 1. Ordering of treatments

Periods 1-10	Periods 11-20	Periods 21-30	No. of sessions	No. of participants
Benchmark	Attribute	Benchmark	3	54
Attribute	Benchmark	Attribute	2	36
Benchmark	Imposed Leader	Benchmark	3	51

Table 2. Earnings of leaders and followers

Frequency of candid. to leadership	Benchmark			Attribute			Imposed leader	
	Groups with leader		Groups w/o leader	Groups with leader		Groups w/o leader	Leader	Follower
	Leader	Follower		Leader	Follower			
Low	20.38	26.74	21.20	17.58	27.05	20.85	20.79	25.59
Medium	19.22	25.05	20.70	19.30	24.75	20.33	20.21	24.49
High	19.44	24.89	20.00	19.28	23.93	20.05	19.06	23.94
<i>Total</i>	<i>19.46</i>	<i>25.79</i>	<i>20.79</i>	<i>19.16</i>	<i>25.77</i>	<i>20.56</i>	<i>20.06</i>	<i>24.69</i>

Note: Low indicates a low frequency of candidacies (< 15% of the periods); High indicates a high frequency of candidacies (>35% of the periods); Medium corresponds to the intermediate frequencies.

Table 3. Average first- and second-stage contributions

Treatments	Benchmark			Attribute			Imposed leader	
	Leader*	Follower		Leader*	Follower		Leader	Follower
		with leader	w/o leader		with leader	w/o leader		
Average contributions, by block of periods								
Periods 1 to 10	12.82	6.98	3.78	12.54	6.44	3.10	..	..
Periods 11 to 20	11.80	4.76	1.19	12.05	4.84	1.43	9.65	5.03
Periods 21 to 30	10.46	3.56	0.94	11.51	4.06	0.49	..	..
Average contributions, by frequency of candidacies								
Low	10.20	3.00	1.46	9.52	3.03	0.95	7.02	3.01
Medium	11.56	7.35	1.61	11.38	6.76	1.49	9.16	5.08
High	12.42	7.98	3.08	12.82	8.60	2.46	13.18	7.32
Total	11.97	5.52	1.84	12.12	5.23	1.40	9.65	5.03
Ratio of followers' contribution to leader's contribution								
Periods 1 to 10	1.25			1.33			..	
Periods 11 to 20	0.78			0.85			1.04	
Periods 21 to 30	0.75			0.74			..	

Note: \*Includes the first stage contributions of the rejected leaders. Low indicates a low frequency of candidatures (< 15% of the periods); High indicates a high frequency of candidatures (>35% of the periods); Medium corresponds to the intermediate frequencies.



Table 4. Determinants of the decisions to lead

Dependent variables	Decision to lead in $t$			Decision to remain as leader in $t$ conditional on leading in $t-1$	
	Endogenous	Benchmark	Attribute	Benchmark	Attribute
Treatments	(1)	(2)	(3)	(4)	(5)
Attribute treatment	.144* (.079) .046	-	-	-	-
Attribute treatment*	-.197**	-	-.213**	-	.055
Matched with 2 low donors	(.105) -.058		(.104) -.067		(.211)
Attribute treatment*	.136	-	.145	-	.231
Matched with 2 high donors	(.118)		(.122)		(.317)
Period	-.024*** (.003) -.007	-.025*** (.004) -.008	-.022*** (.005) -.007	-.008 (.009)	-.009 (.010)
Successive periods with no leader	-.094*** (.032) -.029	-.081** (.037) -.025	-.107** (.046) -.034	-	-
Success in $t-1$	-	-	-	.388*** (.076) .145	.198** (.101) .078
Gender (male=1)	.309** (.131) .097	.342*** (.133) .105	.269 (.205)	.404** (.205) .149	-.113 (.348)
Donation	.002*** (.001) .0006	.002*** (.001) .0007	.002 (.001) .0004	.002** (.001) .0006	-.001 (.002)
Donation * Gender	-.002* (.001) -.0006	-.002** (.001) -.0006	-.002 (.001)	-.001 (.002)	.003 (.003)
Donation * BIB	.001 (.001)	-.001 (.001)	-	-.001 (.001)	-
Neuroticism	.004 (.006)	-.002 (.006)	.011 (.008)	-.013 (.009)	.004 (.012)
Extraversion	-.007 (.005)	-.008 (.006)	-.011 (.009)	-.009 (.010)	-.014 (.013)
Openness	.009 (.006)	.010* (.006) .003	.008 (.010)	.014 (.010)	.013 (.015)
Agreeableness	-.009* (.005) -.003	-.008* (.005) -.003	-.014# (.009)	-.022*** (.008) -.008	-.013 (.012)
Conscientiousness	.008 (.005)	.008 (.005)	.008 (.008)	-.004 (.010)	-.020 (.014)
Session with Attribute treatment played first	.084 (.141)	.016 (.151)	.146 (.166)	-.140 (.292)	.098 (.263)
Session including the Imposed leader treatment	.094 (.148)	.116 (.149)	-	-.369* (.215) -.136	-
Constant	-.778 (.697)	-.658 (.727)	-.581 (1.146)	.818 (1.083)	1.106 (1.731)
Observations	3720	2460	1260	402	217
Log-pseudolikelihood	-1982.487	-1294.103	-680.612	-236.816	-134.848
Wald $\chi^2$	129.10	97.29	60.29	53.15	30.62
Prob> $\chi^2$	.000	.000	.000	.000	0.004
Pseudo R <sup>2</sup>	.064	.067	.069	.107	.096

Notes: Probit models with robust standard errors and clustering at the individual level. \*\*\* significant at the 0.01 level; \*\* at the 0.05 level; \* at the 0.10 level; # at the .12 level. Robust standard errors are in parentheses. Whenever the coefficient estimate is significant, marginal effects estimate is given in italics.

Table 5. Determinants of the leader candidate's contribution

Dependent variable	Amount of the leader candidate's contribution			
Treatments	All treatments (1)	Benchmark (2)	Attribute (3)	Imposed leader (4)
Attribute treatment	3.102** (1.305)	-	-	-
Attribute treatment* Matched with 2 low donors	-5.286*** (1.162)	-	-5.012*** (1.088)	-
Attribute treatment* Matched with 2 high donors	.804 (1.693)	-	.413 (1.599)	-
Imposed Leader treatment	-1.725 (1.382)	-	-	-
Period	-.183*** (.050)	-.211*** (.056)	-.110 (.084)	.242 (.343)
Gender (=1 if male)	-.352 (1.915)	-.858 (2.259)	1.751 (2.127)	-3.497 (4.083)
Donation	-.001 (.008)	-.001 (.008)	.001 (.010)	.003 (.011)
Donation*gender	.014 (.013)	.010 (.016)	.023* (.014)	.001 (.017)
Donation*BIB	.001 (.011)	.006 (.013)	-	-
Frequency of candidacies	2.947*** (1.068)	2.202 (1.711)	4.484*** (1.684)	6.210*** (2.142)
Persistence	-	1.178 (6.271)	3.920 (4.871)	-
Personality traits	Yes	Yes	Yes	Yes
Session with Attribute treatment played first	.857 (2.075)	1.141 (2.559)	.560 (1.902)	-
Session with Imposed leader treatment	.977 (2.096)	.549 (2.076)	-	-
Constant	8.499 (8.720)	10.621 (10.463)	8.305 (12.998)	-11.206 (20.428)
Observations	1124	618	336	170
Left censored obs.	99 (8.81%)	47 (7.61%)	11 (3.27%)	41 (24.12%)
Right censored obs.	332 (29.54%)	180 (29.13%)	114 (33.93%)	38 (22.35%)
Log-pseudolikelihood	-2967.923	-1658.164	-857.780	-425.626
F	4.29	1.76	7.23	1.54
Prob>F	.000	.042	.000	.131
Pseudo R <sup>2</sup>	.023	.013	.049	.033

Note: Tobit models with robust standard errors and clustering at the individual level. \*\*\* significant at the 0.01 level; \*\* at the 0.05 level. Robust standard errors are in parentheses.

Table 6. Determinants of a revision of the eliminated candidates' contributions

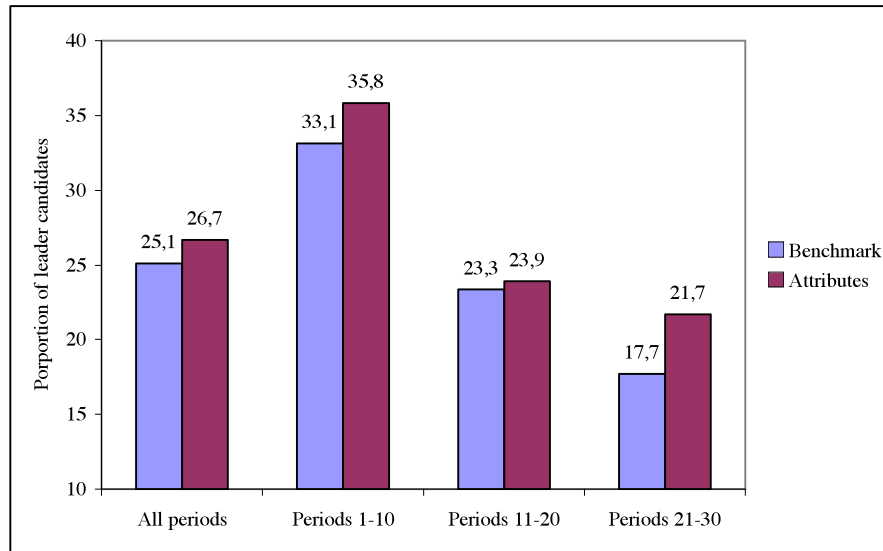
Dep. variable: Revision of contributions	Ordered Probit model	OLS model
Attribute treatment	-.175 (.261)	-1.096 (1.257)
Attribute treatment* Matched with 2 low donors	.601** (.279)	1.894 (1.306)
Attribute treatment* Matched with 2 high donors	-.107 (.349)	.338 (1.286)
Period	.001 (.011)	.039 (.048)
Actual leader's contribution	.067*** (.015)	.494*** (.081)
Frequency of candidacies	.085 (.160)	-.491 (.798)
Persistence	.134 (.424)	-.108 (2.481)
Gender (=1 if male)	-.402** (.174)	-2.701*** (.958)
Donation	.001 (.001)	-.001 (.004)
Personality traits	<i>Yes</i>	<i>Yes</i>
Session with Attribute treatment played first	.225 (.258)	1.248 (1.417)
Session including the Imposed leader treatment	.211 (.201)	1.169 (1.100)
Constant	-	-4.298 (5.982)
Observations	242	
Log-pseudolikelihood	-233.596	-
R <sup>2</sup>	.096 (pseudo)	.287
Wald $\chi^2$	53.42	-
Prob> $\chi^2$	.000	-
F	-	4.62
Prob>F	-	.000

Note: Ordered probit model and OLS models are estimated with clustering at the individual level and robust standard errors in parentheses. \*\*\* significant at the 0.01 level, and \*\* at the 0.05 level.

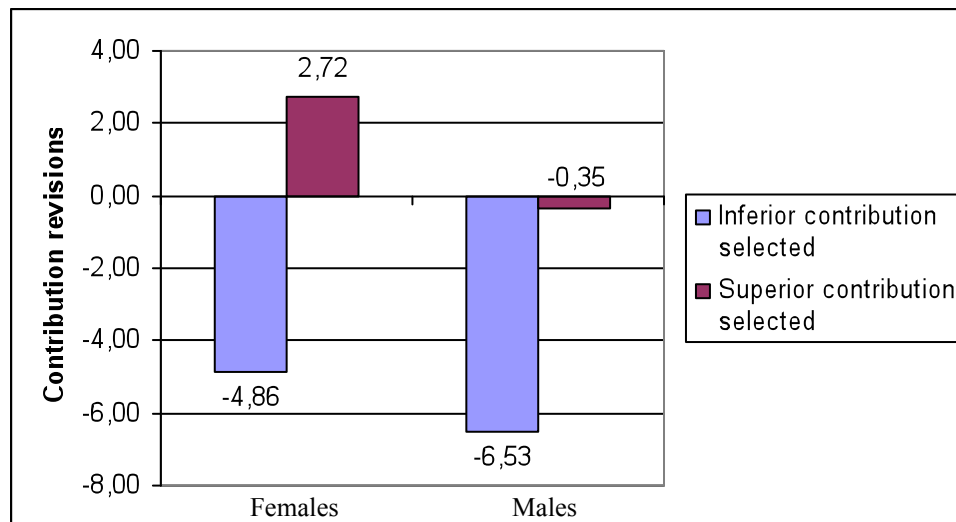
Table 7. Determinants of the follower's contribution

Dependent variables	2 <sup>nd</sup> -stage contribution (Tobit model)	Ratio of followers' contributions to leader's contributions (ordered Probit models)			
	All treatments (1)	All treatments (2)	Benchmark (3)	Attribute (4)	Imposed Leader (5)
Treatments					
Attribute treatment	.344 (1.032)	.122 (.113)	-	-	-
Attribute treatment*	-2.078# (1.329)	-.282** (.132)	-	-.350** (.147)	-
Matched with 2 low donors					
Attribute treatment*	-.615 (1.716)	-.077 (.144)	-	-.087 (.156)	-
Matched with 2 high donors					
Imposed Leader treatment	1.844* (1.015)	.313*** (.092)	-	-	-
Period	-.282*** (.046)	-.027*** (.004)	-.020*** (.005)	-.040*** (.008)	-.082*** (.023)
Leader's contribution	.730*** (.080)	-.005 (.007)	-.003 (.009)	-.003 (.011)	-.005 (.014)
Eliminated leader	5.339*** (.972)	.576*** (.102)	.528*** (.120)	.663*** (.168)	-
Frequency of candidacies	4.400*** (.827)	.408*** (.074)	.396*** (.085)	.525*** (.107)	.295** (.131)
Gender (=1 if male)	-1.489 (1.577)	-.074 (.138)	-.107 (.165)	-.342 (.207)	.230 (.191)
Donation	.008 (.008)	.001 (.001)	.001 (.001)	-.001 (.001)	.001 (.001)
Donation*gender	-.005 (.010)	.001 (.001)	-.001 (.001)	.002 (.001)	-.001 (.002)
Donation*BIB	.005 (.010)	.001 (.001)	-.001 (.001)	-	-
Personality traits	Yes	Yes	Yes	Yes	Yes
Session with Attribute treatment played first	-.454 (1.745)	-.081 (.165)	-.307 (.200)	.101 (.187)	-
Session incl. Imposed leader treatment	-1.522 (1.797)	-.086 (.173)	-.129 (.179)	-	-
Constant	-9.308 (8.564)	-	-	-	-
Observations	1764	1764	926	498	340
Left censored obs.	854 (48.41%)	-	-	-	-
Right censored obs.	171 (9.69%)	-	-	-	-
Log-pseudolikelihood	-3522.174	-1532.548	-803.232	-390.841	-311.395
Wald $\chi^2$	-	160.54	91.77	123.08	75.63
Prob> $\chi^2$	-	.000	.000	.000	.000
F	10.04	-	-	-	-
Prob>F	.000	-	-	-	-
Pseudo R <sup>2</sup>	.078	.099	.097	.172	.074

Note: The Tobit and the ordered Probit models are estimated with robust standard errors clustered at the individual level. In the last regression, the "frequency of candidatures" variable refers to the relative frequency of candidatures of the subject in the periods where he played the Benchmark treatment. \*\*\* significant at the 0.01 level, and \*\* at the 0.05 level; \* at the 0.10 level; # at the .12 level.



*Fig.1. Evolution of the proportion of leader candidates by treatment and by block of periods*



*Fig.2. Revision of contributions in points by eliminated leaders in the endogenous treatments according to gender and the actual leader's relative contribution*

## APPENDIX. Instructions for the Benchmark - Attributes - Benchmark sessions (other instructions available upon request)

You are now taking part in an experiment on decision-making. During this experiment, your earnings depend on your decisions and the decisions of others. It is therefore important that you read these instructions with care.

In most cases, the amounts evoked during this experiment are expressed in points. The conversion rate of points into Euros is:

80 points = 1 Euro

During this session, your earnings in points will be put on your account, cumulated and converted to Euros. The total amount of the compensation you will receive is confidential. It will be paid in cash in private in a separate room by a person who is not aware of the content of this experiment.

All your decisions are anonymous.

This session is divided into four parts. The instructions relative to the parts 2 to 4 will be distributed later.

-----

Before starting the first part, we give you a show-up fee of €6. With this show-up fee, you can put Euros on your account and make a donation to a charitable organization.

- ☐ You can put Euros on your account. The amount of the show-up fee that you put on your account will be added to your earnings made during this session and paid to you in cash at the end of the session.
- ☐ You can make a donation to a charitable organization, among the three following: *Handicap International*, *Médecins sans Frontières*, ou *UNICEF*. You can find a description of each of these organizations in Appendix to these instructions.

If so, your donation will be made in private at the end of the session in a box in the payment room in presence of a person who is not aware of the content of this experiment.

We commit on our honor to give the entirety of these donations to these organizations. If you want to receive personally a receipt justifying the payment of all the donations to the three associations, please fill out the form attached to these instructions.

To make your decision, you are required to click one of the combinations displayed on your screen (from €0 for the donation and €6 put on your account, to a €6 donation and €0 put on your account). If you have chosen to make a donation, you will then indicate whom of the three organizations you want to give your donation to.

The information on your donation can be disseminated, anonymously, to the other participants during this session, as follows:

- ❖ A yellow disc indicates that your donation is higher than the average donation made by the participants to this session.
- ❖ A grey disc indicates that your donation is equal to or lower than the average donation made by the participants to this session.

You will also be requested to indicate your gender. This anonymous information is also liable to be disseminated to the other participants during the session. In all cases, you will be informed in the instructions preliminary to the dissemination of these pieces of information.

### ***First Part***

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly.

### Decision-making in each period

The three members belonging to a group can participate in a project, by constituting an amount that will be shared equally among them. This amount results from the individual contributions of the three group members.

In the beginning of each period, you receive an endowment of 20 points.

Each period consists of two stages.

- ❑ **In the first stage**, you decide if you are willing to make your contribution decision immediately or if you prefer to wait for the second stage.

Make your decision immediately means that you choose in the first stage the amount of your contribution to the project. This amount can take any possible value between 0 and 20 points.

The two other group members are informed on this contribution before making their own contribution decisions in the second stage.

In the group, only one member can contribute in the first stage. Three cases can occur.

- *1st case*: only one member has chosen to make his contribution decision in the first stage. The procedure described above applies.
  - *2<sup>nd</sup> case*: more than one member in the group have chosen to make their contribution decisions in the first stage. A random draw determines the one whose contribution is taken into account. This random draw is independent on the chosen amount. The one or those who have not been randomly drawn are informed; their first stage contribution is not accounted for and the other group members are not informed about this contribution; they move to the second stage and they can modify the contribution they had previously indicated. Only those who were involved in the random draw and have not been drawn are informed about the existence of this random draw.
  - *3<sup>rd</sup> case*: no member in the group has decided to contribute in the first stage. The three group members move directly to the second stage.
- ❑ **In the second stage**, after being informed of the contribution made by the member who has made his decision in the first stage, if any, the group members who have not decided in the first stage choose simultaneously the amount of their endowment they contribute to the project, i.e. any value between 0 and 20 points.

After all members have made their decisions, each one in the group is informed about the amount of each member's contribution in the second stage, the total amount of the project and his own payoff for the current period.

### Calculation of your payoff in each period

- ❑ Your income consist of two parts:
  - the amount of your endowment which you have kept for yourself (i.e. 20 points – your contribution to the project),
  - your income from the project: this income represents half of the total contribution of all 3 group members to the project, whatever your personal contribution. In other words, we increase the amount of the project by 50% of the contributions and the total amount of the project is shared equally among the members of the group.

Your total income is therefore calculated by the computer program as follows:

$$\begin{aligned} & (20 \text{ points} - \text{your contribution to the project}) \\ & + 50\% (\text{total contributions to the project}) \end{aligned}$$

The income of each group member is calculated in the same way, this means that each group member receives the same income from the project.



For example, suppose the total contributions of all group members is 40 points. In this case each member of the group receives an income from the project of  $1/2 (40) = 20$  points. If the total contribution to the project is 5 points, then each member of the group receives an income of  $1/2 (5) = 2.5$  points from the project.

For each point of your endowment that you keep for yourself you earn an income of 1 point. For every point you contribute to the project instead, the total contribution rises by one point. Your income from the project would rise by  $1/2 (1) = 0.5$  point. The income of the other group members would however also rise by 0.5 point each, so that the total income of the group from the project would rise by 1.5 point. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each point contributed by the other members to the project. For each point contributed by any member you earn  $1/5 (1) = 0.5$  point.

It is prohibited to communicate with the other participants during the experiment. If you violate this rule, you will be excluded from the experiment and from payments.

If you have any question regarding these instructions, please raise your hand. We will immediately answer to your questions in private.

\* \* \*

### ***Second Part***

*[These instructions were distributed at the end of the first 10 periods]*

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly.

The rules for decision-making are the same as before, except for one thing.

In the beginning of each period, you are informed about the attributes of each member of your group and the other members of your group are informed about your attributes. These anonymous attributes are your gender and the color corresponding to your donation (a yellow disc for a donation above the average donation made in the session and a grey disc for a donation equal to or below the average).

Each contribution, made either in the first or in the second stage, is displayed on your screen beside these attributes.

The payoffs of each period are calculated like in the first part.

\* \* \*

### ***Third Part***

*[These instructions were distributed at the end of the first 20 periods]*

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly. During this part, the instructions are those in use during the first part.

\* \* \*

### ***Fourth Part***

This fourth part consists of a questionnaire comprising 60 affirmations. Please read each of them carefully. For each item, please circle that of the five boxes which fits your opinion best:

Circle **SD** (Strongly Disagree) if the affirmation is quite wrong or if you strongly disagree.

Circle **D** (Disagree) if the affirmation is rather wrong or if you disagree.

Circle **N** (Neutral) if the affirmation is almost equally wrong or true or if you cannot choose or if have no opinion.

Circle **A** (Agree) if the affirmation is rather true or if you agree.

Circle **SA** (Strongly Agree) if the affirmation is quite true or if you strongly agree.

There is no "good" or "bad" answer. The aim of the questionnaire will be reached if you describe yourself and if you express your opinions as exactly as possible. Answer to each question. If you made a mistake or if you change your mind, do not erase. Put a X on the incorrect answer and circle the correct answer.

You will earn 2 additional Euros for filling this questionnaire out. Your answers are of course still anonymous and will never be communicated to anyone. I thank you for filling this questionnaire sincerely.